NRC Review Weak Lensing Charts

V1

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Weak lensing comparison

	Euclid	IDRM	AFTA
Shape bands	1 [Vis]	2 [J/H]	3 [J/H/F184]
PSF EE50	0.13" [Vis]	0.16" [J]	0.12" [J]
Galaxy density n_{eff} (gal/am^2) [Cuts: Res>0.4, S/N>18, σ_e<0.2]	35 [21 with $N_{exp}\geq 3$*]	26/28 [36 stacked]	54/61/44 [74 stacked]
# Exposures per galaxy	3—4	10	16
# Observing passes per field§	1	4	6
Sky coverage (deg^2)	15,000 [primary mission]	2,700 [in 1 year]	2,050 [in 1.17 years]
Statistical error on amplitude of matter fluctuations	0.08%	0.13%	0.10%
Median source redshift	0.8	1.0	1.2

* Defined as 3 exposures with no cosmic ray within 3 pixels of the galaxy center (the same cut as used in the WFIRST forecasts).

§ The number of passes differs from the number of exposures in that small-step dithers are not counted as separate. This determines the number of repeat observations available for null tests.

Why the WFIRST survey strategy?

- Multiple passes and filters are essential for systematics control.
  - When measuring small signals underneath much larger systematics, a signal must be repeatable for it to be considered reliable.
  - Enables a range of null tests using both cross- and auto-power spectra.
  - True in both WL and galaxy clustering. See SDSS, where "single pass" strategy has resulted in systematics limit in e.g. non-Gaussianity studies. (Cosmology has had similar experiences at other wavelengths.)
  - Observations at multiple wavelengths change the PSF and detector properties, but should leave the cosmological parameters invariant.

- The SDT judged survey redundancy to be worth the "loss" of sky coverage. AFTA provides the ability to do this while still reaching 0.1% statistical precision.